Danish Wind Power

A journey beyond Imagination

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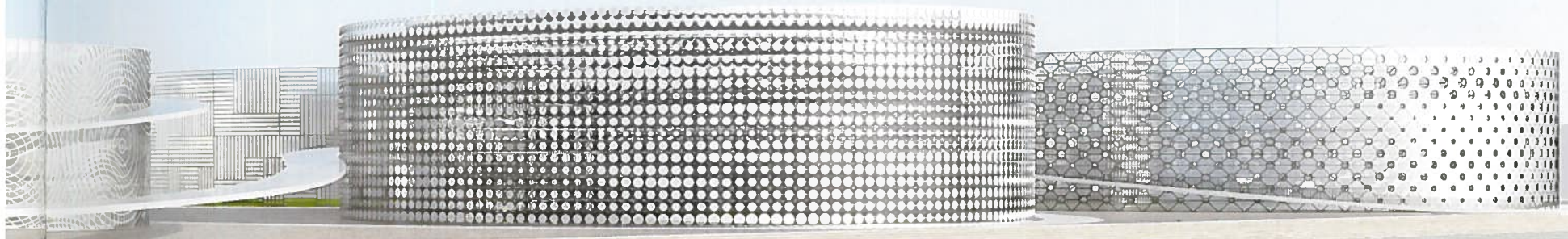

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INTRODUCTION

New Energies

Robert Ferry and Elizabeth Monoian

In 2012, the Land Art Generator Initiative design site at Freshkills Park brought forth hundreds of ideas about how we can creatively adapt our reclaimed landfills for renewable energy infrastructures, seamlessly integrated into a regenerated natural environment—beautiful public energy parks to power hundreds of homes while providing safe places for people to recreate and learn. The juxtaposition of reclaimed landfill and energy infrastructure design provided a fertile conceptual terrain onto which artist teams imagined their work.

In 2014, LAGI has explored new territory with new conceptual frameworks. The 2014 site at Refshaleøen is an industrial brownfield site. Its history is unique (as you will read in the essay by Annette Skov on page 16), but every city has a site similar to this. These are places where residential development is not yet possible due to high levels of environmental pollutants deposited year after year during a long industrial past. In places such as these, there is a great opportunity to conceive of iconic public art installations that can stand watch over history until the ground and air are clean enough to be sustainably developed into the fold of the growing city. In the meantime, these sentinels can serve to reduce our dependence on fossil fuels by generating clean, renewable electricity for the city.

The entries to this year's competition have once again pointed the way to a future in which our sustainable energy systems can exist in complete harmony with the living city around us.

Will humanity transition to 100% carbon-free energy? Yes, we will because we must, and the solutions already exist.[1] Fossil fuels are a finite resource and their unrestrained extraction/combustion is damaging to human health and the environment.[2] The question is: how difficult will the change be, and how long can we put off the inevitable before the effects of climate change bring suffering to millions and ruin to the global economy?

If we are to make a fairly seamless transition, then we must possess an appreciation for history and acknowledge that individuals and corporations acting without adequate government coordination and leadership will not be able to find solutions quickly enough.

Consumer movements, activism, and corporate responsibility have brought us to a point in time where a clear majority of people are in favor of public investment in renewable energy. If we are to continue to rely mostly on the marketplace to dictate the terms of the transition, all progress will be threaded through the financing needle of net present value determinations using time horizons that are too short-sighted for our long-term collective interest.[3]

Instead, we desperately need a coordinated effort organized by governments, and policies that can override the short-term economic models. According to the International Energy Agency, in order to meet the global carbon reduction challenge, the world will need to invest $6 trillion over the next 25 years.[4]

When we are facing a collective challenge such as this, we would be wise to transcend narrow commercial interests and recognize the value of economy-wide returns like those associated with renewable energy investment. We have done this before during times of critical mass determination, in order to address social injustices or to expand the boundaries of scientific progress.[5]

1 Mark Z. Jacobson, Guillaume Bazouin, Zack Bauer, et al., "100% Wind, Water, Sunlight (WWS) All-Sector Energy Plans for the 50 United States," (Atmosphere/Energy Program, Dept. of Civil and Environmental Engineering, Stanford University, July 17, 2014). **http://web.stanford.edu/group/efmh/jacobson/Articles/I/USStatesWWS.pdf (http://thesolutionsproject.org)**

2 If we are to avert the most devastating effects of global climate change by staying at or below 2° Celsius of warming, we must abandon (leave in the ground and not use) 80% of the proven reserves of fossil fuels that the industry is now claiming on their balance sheets as assets. For more information, refer to the Carbon Tracker Initiative's report, "Unburnable Carbon" at **http://carbontracker.org**

3 A rate of return of 12–15% (IRR) and investment horizons of 7–10 years are a barrier to some renewable energy investments, which may require more than a decade to achieve strong returns on investment. Technological innovation to reduce the EROI (energy return on energy invested) of renewable energy systems (to make them more competitive with fossil fuels in the marketplace) requires expensive research and development that is not easily borne by the private sector. Feed-in-tariffs, portfolio standards for utilities, and tax incentives can make renewable projects more commercially attractive to private investors, but the fact that global GHG emissions continue to increase year-on-year shows that these mechanisms alone are not sufficient.

ESSAY

Danish Wind Power: A Journey Beyond Imagination

Peter Karnøe

"You may discuss as much as you like but nuclear power is what you will get."

—Chairman of the Danish electrical utilities, 1976

"[We have] set the goal that by 2020 50% of Danish electricity production is to be generated by wind power."

—Energy Act passed by the Danish Parliament, 2012

"Wind power is now mainstream technology."

—Spokesperson from Global Wind Energy Council, 2014

As these three contrasting statements from 1976, 2012, and 2014 indicate, the status of wind power has changed in Denmark as in many other countries. According to these statements, wind power has made a dramatic shift from being unwanted by the energy establishment to becoming dominant, even categorized as mainstream. This is indeed a journey beyond imagination, and yet, not so atypical for innovations that shift the order of things in societies through what Schumpeter called "creative destruction."

This essay deals with the Danish part of this journey and uses actor-network theory as a framework for analyzing what happened between the above statements. Actor-network theory attends particularly to how technological projects, organizations, institutions like the "market" and the "economy," habits, and ideas come into existence through the actions of micro-actors, to become macro-actors that constitute societal orders. For example, in 1980, when 98% of electricity in Denmark was generated by centralized fossil fuel, the power plants represented a particular macro-actor, the result of a long struggle to put together the socio-technical bits and pieces that enabled centralized electricity generation to grow from 12% in 1923 to 98% in 1980. Wind power generated 0% electricity in 1976. In the context of the total dominance of centralized electricity generation, it did not seem to be a technological project that had much chance of success, but some had started to make narrative declarations, such as the policy statement, "there can, and there should be wind power in Denmark," or local actors posed the question, "how is it possible and desirable for me to develop wind power?"

Between 1976 and 2012, something apparently happened within the network of wind power and the networks of centralized electricity power plants. If we turn to actor-network theory (ANT), one critical lesson is that being dominant and "powerful" in a society, and being represented by relatively homogeneous voices (like the 1976 statement from the utility chairman) is the outcome of a struggle, and it is not known at the outset which technology will become or remain dominant.

In order to understand some of the changes, we can follow the making of a network, which was built gradually to form a context. Within this context, the narrative programs of action for wind power could be realized by being translated into a seamless web or a network of durable materials and relations. Rather than seeing the world as composed of pre-given objects, ANT tries to understand the ways in which they come into being. ANT seeks to understand the making of facts and functionalities by employing a constructivist and realist (empirical, "positivist") approach at the same time. Realities such as scientific truth and the functional qualities of technologies like the combustion engine or the computer chip are both constructed and made real by particular socio-material actions, such as measuring, calculation, drawing graphs, designing machines, and shaping materials (Callon, 1986a and 1986b, Callon et al. 2002, Law, 1992, Latour, 1991, 1999). Accordingly, the scientific